CHAPTER 3

SERVICE NEED

Nullinga Dam and Other Options Preliminary Business Case

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3 SERVICE NEED

CHAPTER SUMMARY AND CONCLUSIONS

Urban Demand

- There is no Cairns urban water supply service need to be addressed in the PBC.
- Under current population/demand forecasts, Cairns Regional Council (CRC) has an implementation plan of CRC owned and operated supply measures in place within existing regulatory frameworks to meet its future demand for at least the next 30 years, including the revised proposal for the Aquis Resort. CRC does not have an identified need for water from a new regional source (such as Nullinga Dam) until the very long term.

Agricultural Demand

- The identified service need to be addressed in the PBC is an opportunity to expand agricultural production on the Atherton Tableland by increasing the availability of supplemented medium priority (MP) allocations.
- In addressing this opportunity, two existing issues should be considered:
  - Agricultural production and growth is constrained when irrigators exceed their stated 'scarcity buffer' (e.g. 70 to 80 per cent water use as a portion of available allocations) and conserve water to protect longevity of crops at dry times
  - Water cannot be moved to certain areas because of constraints in the MDWSS water distribution system (e.g. East Barron and Arriga areas) and a lack of infrastructure in greenfield areas.
- The benefits of meeting this service need include an increase in value of agricultural production, arising from better use of existing infrastructure and/or the construction of new infrastructure, resulting in more direct and indirect jobs. Flow-on benefits include broader improvements to community health and wellbeing.
- The removal from the service need of the provision of water supply to Cairns removes a critical point of potential conflict between CRC and the Tablelands community.
- The base case represents the business-as-usual scenario and is likely to feature:
  - Little or no increase in water deliveries to the extent that available capacity within water distribution infrastructure has, or is close to being, reached (when available, 2016–17 system usage data will assist to establish if this is the case)
  - Increased moves by the irrigation sector towards on-farm water efficiency and higher value production (to the extent that high-value producers have not already reached optimal water use, as trickle irrigation is widely used on tree crops)
  - Water trading at high values towards high value crops on the most fertile soils within the scheme – leading to an expansion of high value horticulture within the region
  - Static or potentially modest expansion of sugarcane production by MSF Sugar and other producers resulting from increased yields due to improvements in on-farm water use efficiency. Given the current water constraints, the base case is unlikely to see expansion of sugar cane without a new source/supply of water allocations.

3.1 Purpose

This chapter summarises the current situation, the method and activities undertaken to determine the service need and stakeholder views. It then defines the service need proposed to be addressed in the PBC and outlines the benefits from addressing the service need and base case considerations.

3.2 Current Situation

3.2.1 Cairns

3.2.1.1 Current Water Supply

CRC has two main water supply sources:

- Copperlode Falls Dam on Freshwater Creek, forming Lake Morris. Water is released from Copperlode Falls Dam into Freshwater Creek with the intake located at Crystal Cascades Weir. Raw water is extracted at the intake and treated at the Freshwater Creek Water Treatment Plant.
- Behana Creek, south of Gordonvale. Water is extracted directly from a small weir in the creek, with extraction rates depending on flow conditions.

These two sources are owned and operated by CRC and operated in tandem on a day-to-day and seasonal basis to meet water requirements in Cairns. CRC has adopted a Level of Service of 26,000 megalitres per annum (ML/a) as the available yield from these sources.

CRC's system provides treated/potable water access to approximately 154,000 people, or about 98 per cent of the population within the Cairns local government area. Industry within the reticulated area is also connected to the reticulation network. Tourism is an additional significant factor for water supply, with over two million visitors to the region providing an additional estimated transient population of up to 40,000 visitors to Cairns on any one night. CRC does not supply water to irrigated agriculture.

3.2.1.2 Water Security Strategy

In 2015, CRC released the Cairns Water Security Strategy, which set out a preferred strategy for implementing a series of short, medium and long-term initiatives to address the future demand for water in Cairns over the next 30 years. The preferred initiatives are provided in Table 1.

Table 1 Cairns Regional Council Water Security Strategy Initiatives

INITIATIVES	COMMENTS	Estimated Yield
Short-term (1–5 years)		
Demand management Smart meters	Currently being undertaken Continue existing initiatives such as community education programs. Also, new initiatives such as water efficient appliances for new residential and non-residential developments	Estimated savings 3,026 ML/a over four programs
Level of Service review	Currently being undertaken May result in increase in current Level of Service yield from Copperlode Falls Dam and existing Behana Creek of 26,000 ML/a	Unknown

INITIATIVES	COMMENTS	Estimated Yield
Behana Creek improvements (including Draper Road Water Treatment Plant Stage 1)	Currently being undertaken Extraction at Behana Creek is currently constrained by existing treatment processes and capacity. Upgrading the water treatment plant will increase the volume of water extracted	1,000 ML/a
Mulgrave River Stage 1	Run of river extraction at Gordonvale	5,000 ML/a
Medium-term (5–10 years)		
Barron River Stage 1 (including Kamerunga Water Treatment Plant Stage 1)	Accessing a small reserve of the Barron River at Lake Placid. Preferred sequence of medium-term options subject to further investigation and comparative assessment	5,500 ML/a
Mulgrave River Stage 2 (including Draper Road Water Treatment Plant Stage 2)	Entitlements held by Mulgrave Mill at Gordonvale on the Mulgrave River could be traded to the CRC. Or further extraction from the Mulgrave River. Preferred sequence of medium-term options subject to further investigation and comparative assessment	8,500 ML/a
Long-term (10–30 years)		
Further development of Mulgrave River water source ensuring cumulative capacity is less than 15,000 ML/a	All long-term options are subject to further investigation of availability, impact and cost Of the final two initiatives, the preferred sequence is (1) conversion of MDWSS losses and (2) new regional supply, nominally Nullinga Dam	
Purchase and utilise part of the 19,000 ML/a Mulgrave Mill water entitlement		
Investigate the possibility of use of appropriately treated water for other purposes		
Conversion of MDWSS operational losses to allocations for urban use by Cairns		
Access water from a future regional dam (e.g. Nullinga Dam)		

Source: Cairns Water Security Strategy, 2015

The Cairns Water Security Strategy was developed between April 2014 and February 2015 with involvement from a community-based Water Security Advisory Group and Technical Project Team. The Cairns Water Security Strategy baseline forecast was:

- Medium population growth forecast as per the Queensland Regional Statistical Information System
- Total system water demand of 418 litres per resident person per day
- An allowance for non-residential demand (including tourism) to grow in direct proportion to population growth.

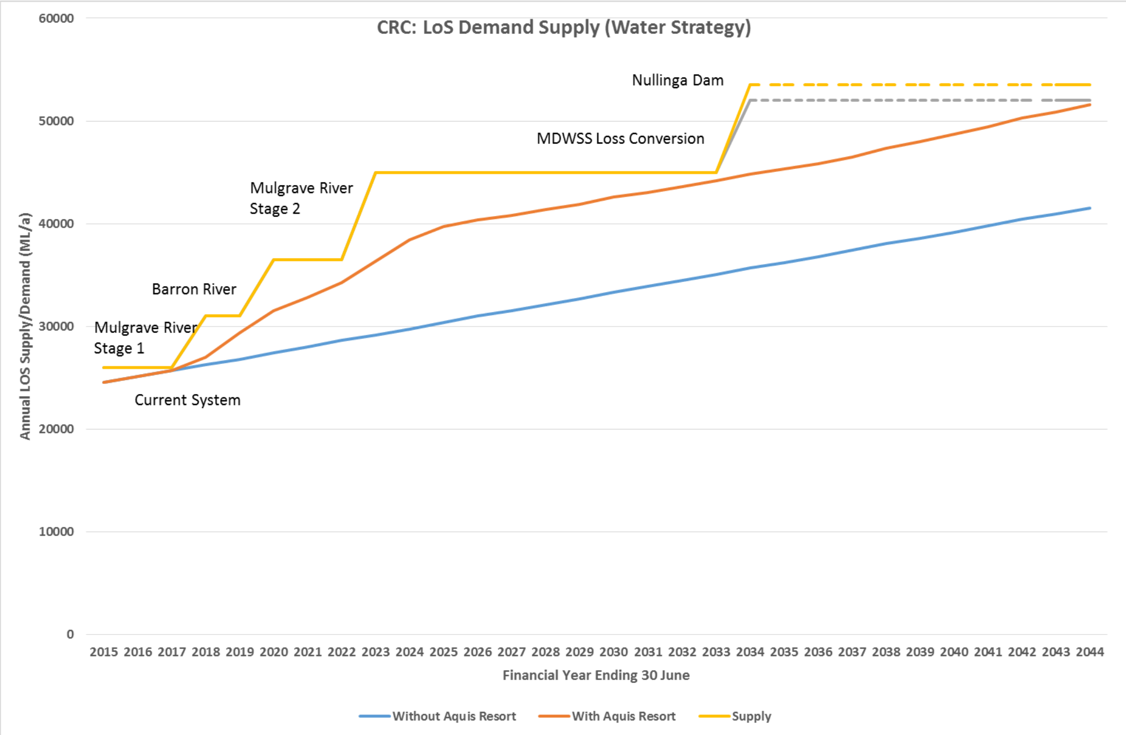
The Cairns Water Security Strategy is subject to annual review.

3.2.1.3 Aquis Great Barrier Reef Resort

The proposed Aquis Resort site is at Yorkeys Knob, north of Cairns. At the time of the Cairns Water Security Strategy, the proposed resort had a planned capital investment of $8 billion, and involved a large entertainment and hotel complex which included casinos, theatres, convention spaces and accommodation for 12,000 guests.

Water demand from the proposed Aquis Resort would be supplied by CRC from its water supply system. CRC consequently modelled two demand forecasts for the Cairns Water Security Strategy, one which included the proposed Aquis Resort ('with Aquis') and one which did not ('without Aquis'). Under the Cairns Water Security Strategy, Cairns would require longer term water supply augmentation from regional sources such as the proposed Nullinga Dam by 2035 if the proposed Aquis Resort was developed. The demand profile in the Cairns Water Security Strategy showing the two scenarios is provided in Figure 1.

Figure 1 Forecast Demand and Supply Strategy in Cairns Regional Council Water Supply Strategy



Source: Cairns Water Security Strategy, 2015

3.2.2 Barron Water Plan area and Mareeba-Dimbulah Water Supply Scheme

3.2.2.1 Barron Water Plan

The Barron Water Plan 2002 area spans over 2,100 square kilometres and comprises these catchments:

- Barron River catchment
- Walsh River catchment upstream of Flatrock gauging station
- Mitchell River catchment upstream of Lake Mitchell.

All supplemented, un-supplemented surface water and groundwater in the plan area is managed in accordance with the Barron Water Plan and the Barron Resource Operations Plan.

3.2.2.2 Mareeba-Dimbulah Water Supply Scheme

The MDWSS is the major water resource development in the Barron Water Plan area and services circa 70 per cent of Far North Queensland's water entitlements.

The MDWSS is currently owned and managed by SunWater and comprised of Tinaroo Falls Dam and an extensive distribution system. Tinaroo Falls Dam stores and releases water for irrigation, town water supply, potential hydroelectricity generation opportunity and recreation purposes. The distribution system is comprised of 12 sub-systems, a number of weirs, 375 kilometres of channels and pipelines and 61 kilometres of drains. The sub-systems and water use profile for each sub-system are outlined in the figure and table below.

The MDWSS currently services around 1,125 customers. The supply values are limited by infrastructure capacity and losses. MDWSS water allocations and use are as follows.

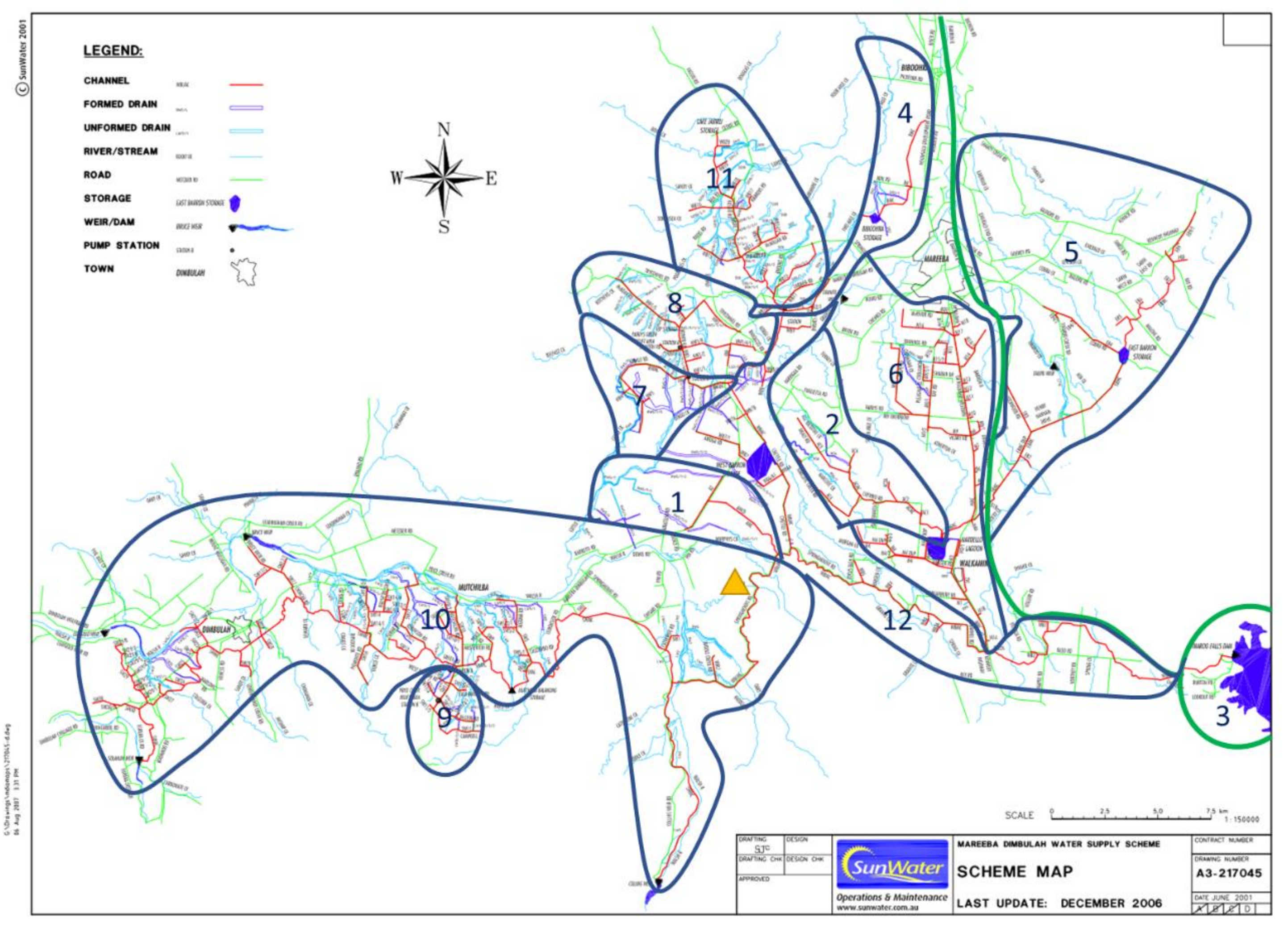
Table 2 MDWSS Allocations and Use

CUSTOMER SEGMENT	WATER ENTITLEMENTS (ML)	WATER AVAILABLE (INCL. CARRYOVER) (ML)	WATER DELIVERED (ML)	TEMPORARY TRADING (ML)	COMMENT
Industrial	1,351	1,341	899	310	Barron Gorge Hydroelectric Power Station
Irrigation	151,412	160,193	125,503	45,413	Agricultural use
Urban	6,655	6,659	4,039	439	Towns: Tinaroo, Mareeba, Mutchilba and Dimbulah.
SunWater	45,006	45,003	31,621	0	Losses
Total	**204,424**	**213,196**	**162,062**	**46,162**	

Source: SunWater, Annual Report 2015-16 (Scheme Statistics). Note: Data excludes riparian allowance, channel and river harvesting

The *Water (Local Management Arrangements) Amendment Act 2017* was passed by the Queensland Parliament on 16 February 2017 to enable irrigators from regional communities to manage their own water distribution schemes. The Queensland Government is currently investigating transitioning the MDWSS distribution system to LMA. The MDWSS LMA Investigation Board is due to deliver its revised business case to the Queensland Government, setting out how they may operate under local management, by October 2017. The Queensland Government will then consider whether the MDWSS is ready to commence the transition to local management. If this proceeds, the MDWSS distribution infrastructure business, assets and liabilities will be transferred from SunWater to a new local management entity, and SunWater would retain responsibility for Tinaroo Falls Dam as the bulk water supply to the MDWSS.

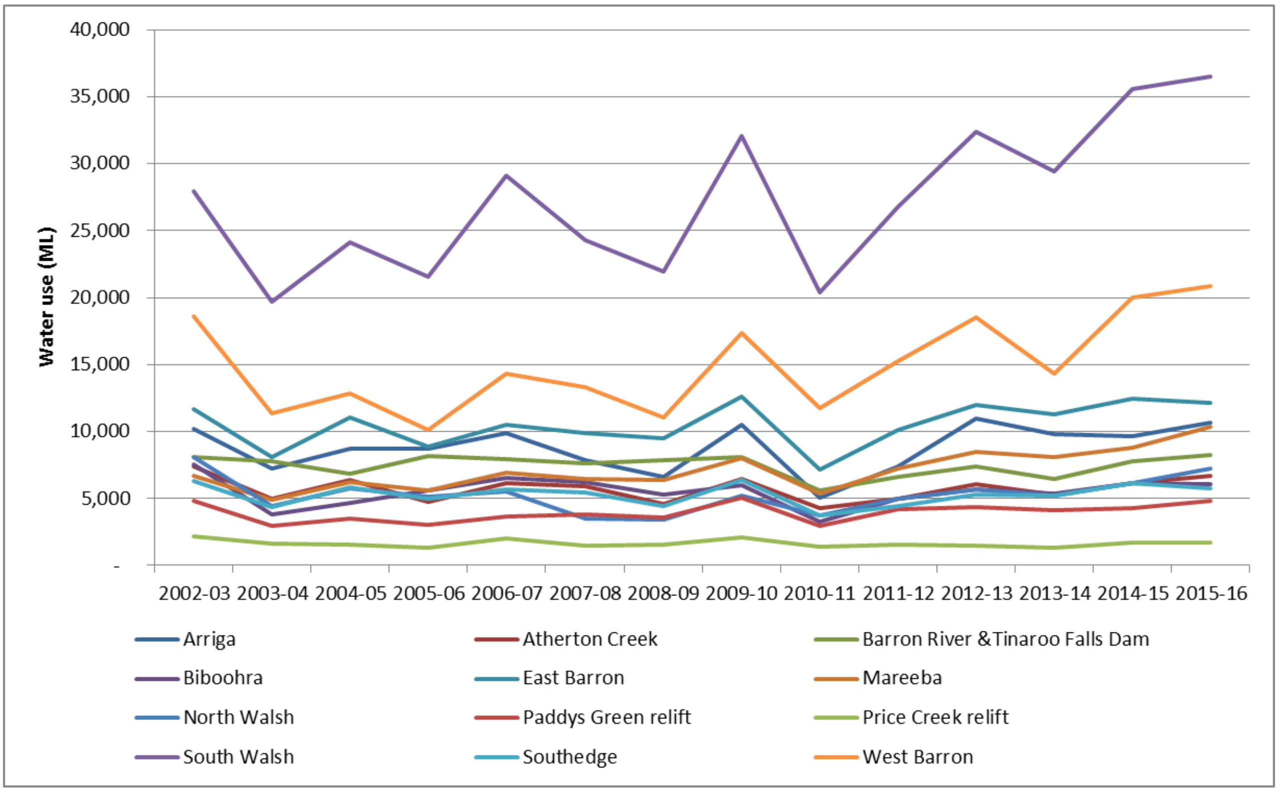
Figure 2 MDWSS Operational Systems



Source: SunWater

Note: 1. Arriga, 2. Atherton Creek, 3. Barron River & Tinaroo Falls Dam, 4. Biboohra, 5. East Barron, 6. Mareeba, 7. North Walsh, 8. Paddy's Green relift, 9. Price Creek relift, 10. South Walsh, 11. Southedge, 12. West Barron. Yellow triangle denotes location of MSF Sugar's Tablelands Mill

Figure 3 Water Use by MDWSS Operational Systems



Source: SunWater and MJA analysis

3.2.2.3 Irrigated Agriculture

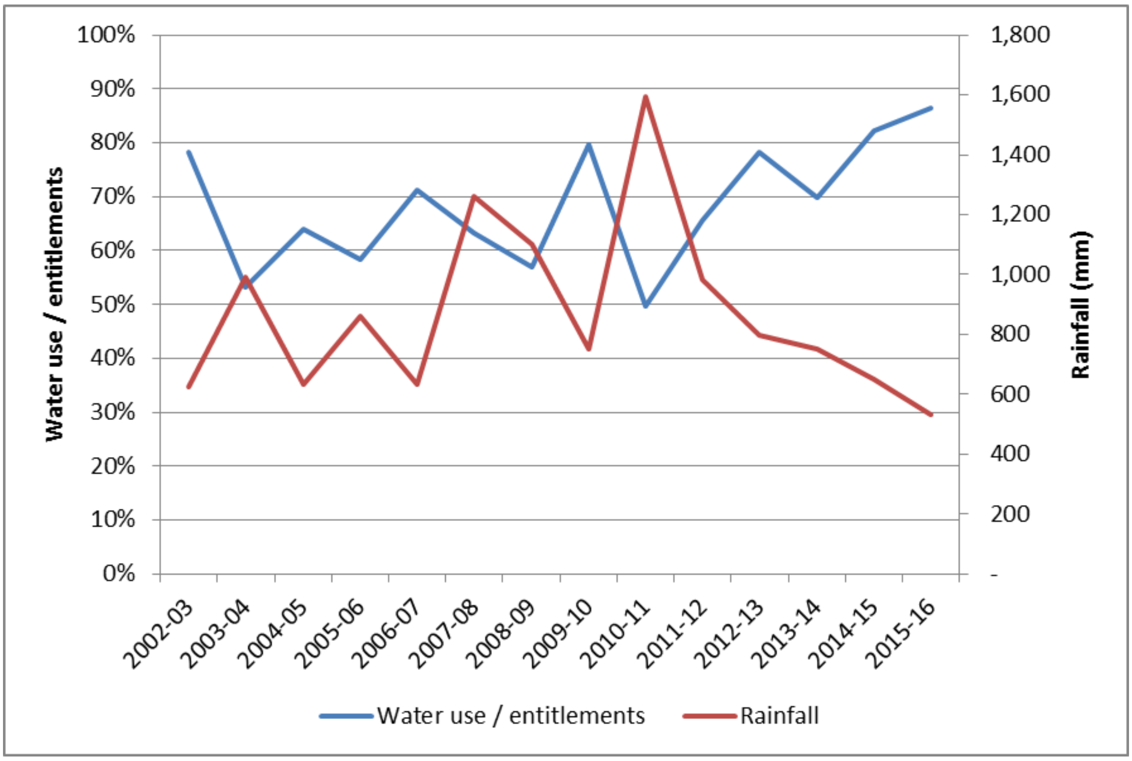
Irrigation is the largest component of water use in the MDWSS. The DAF Queensland Agricultural Audit (2013) identified the MDWSS as the most important agricultural area in Far North Queensland.

Water allocations in the MDWSS are currently fully allocated. Alternative options will therefore need to be progressed to allow for a potential expansion of irrigated agriculture within the area and surrounding region.

The MDWSS provides water to about 25,000 hectares of irrigated agriculture. The distribution of water within the MDWSS is primarily gravity fed. This means the distance and time-lag associated with supply from Tinaroo Falls Dam to the outer zones in the western area is greater than two days and leads to higher comparative delivery losses/inefficiencies for this area.

Water use in the MDWSS is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of entitlements) is generally 60 to 70 per cent. However, the recent dry conditions have persisted since 2012-13 and as a result the level of utilisation in 2015-16 was about 86 per cent as shown in Figure 4.

Figure 4 Water Use and Rainfall in the MDWSS

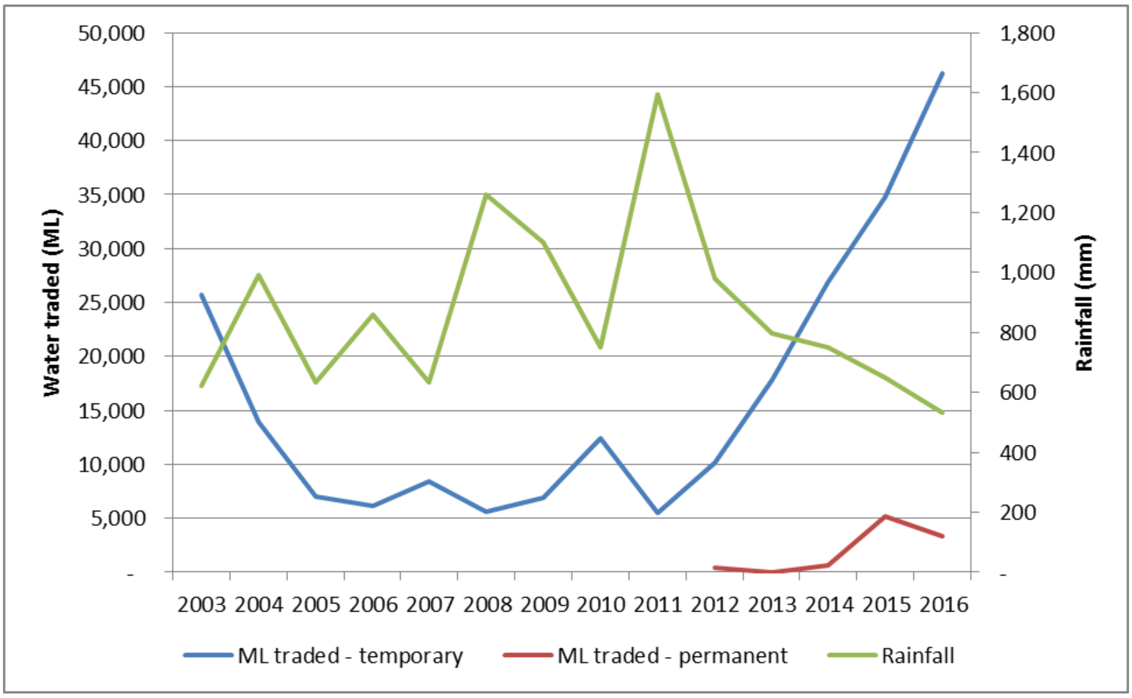


Source: SunWater, http://www.bom.gov.au/climate/averages/tables/cw_031066.shtml and MJA Analysis

3.2.2.4 Water Trading in the Mareeba-Dimbulah Water Supply Scheme

Supplemented water allocation holders in the MDWSS have had the benefit of water trading since 2001. The level of water trading has increased in recent years due to dry conditions and the increasingly high value of crops, as indicated in the figure below.

Figure 2 Water Trading and Rainfall in the MDWSS



Temporary water trading data from SunWater's recent annual reports outlined in the table below shows a significant increase in temporary trading volumes in the past few years.

Table 3 Temporary Trading in MDWSS Over Time

ITEM	2012–13	2013–14	2014–15	2015–16	CHANGE 2013 TO 2014	CHANGE 2014 TO 2015	CHANGE 2015 TO 2016
Irrigation temporary trading (ML)	26,486	26,089	34,089	45,413	-1%	31%	33%
Irrigation water delivered (ML)	112,265	100,136	119,564	125,503	-11%	19%	5%
Irrigation temporary trading as a portion of irrigation water delivered	24%	26%	29%	36%	10%	9%	27%
Irrigation water entitlements (ML)	151,298	151,563	151,412	151,412	0%	0%	0%
Irrigation temporary trading as a portion of irrigation water entitlements	18%	17%	23%	30%	-2%	31%	33%

Source: SunWater Annual Reports 2012–13, 2013–14, 2014–15, 2015–16

The following table provides an estimate of temporary trading at the increasing temporary trading water price over the same period.

Table 4 Increase in Temporary Trading Price in MDWSS Over Time

ITEM	2012–13	2013–14	2014–15	2015–16	CHANGE 2013 TO 2014	CHANGE 2014 TO 2015	CHANGE 2015 TO 2016
Trading value ($per ML)	80	100	120	140	25%	20%	17%
Value of temporary trading ($ million)	2.12	2.61	4.09	6.36	23%	57%	55%

This analysis reveals the temporary trade values have increased over the past few years to exceed the value of the fixed distribution system annual charges (e.g. approximately $80 per ML). The value of temporary trading is estimated to be $2.1 to $6.3 million annually in the MDWSS, demonstrating rising scarcity of water in the scheme.

It is difficult to obtain reliable permanent water trading values because in most cases when DNRM receives notification of water and land sales, the price paid is bundled for the water and land titles together and DNRM uses its judgement to apportion dollars to the different titles.

Price transparency in the market is a key issue as water transfers are facilitated by private parties. For instance, the price of permanent transfers of water from anecdotal evidence is significantly higher than reported by DNRM[1], which shows permanent transfers during September 2016 were $1,938 per ML (volume

1 https://www.business.qld.gov.au/industry/water/managing-accessing/markets-trading/market-information

weighted average price). Consultation undertaken for the PBC indicates that water is currently (e.g. 2016-17) being permanently traded in the range of $2,000 to 3,000 per ML—with a midpoint of $2,500 per ML. It is understood SunWater's current midpoint for the MDWSS is $2,600 per ML.

In addition to the trading data, there is evidence the water market in the MDWSS appears to be maturing via the presentation of property by owners (via real estate agents) of water and land as separate values.

3.3 Method and Activities

The service need was developed as follows:

- Review background documents to determine previous assessments of the service need.[2]
- Review MJA Demand Report and Jacobs peer review of the MJA demand assessment.
- Present the proposed water demand profile for urban water supply for Cairns and agricultural water supply on the Tablelands to the Stakeholder Reference Group and receive feedback.
- Develop a potential definition of the service need via consideration of past problem/opportunity definitions and emerging problem/opportunity definitions.
- Hold internal workshops and workshops with key agencies to establish a proposed service need
- Test the proposed service need via consultation with key regional stakeholders and water customers in the MDWSS.
- Present the proposed service need to the Project Steering Committee for consideration and endorsement.

3.4 Previous Assessments of the Service Need

Nullinga Dam has been proposed to meet a variety of water supply needs over time (see table 5).

Table 5 Nullinga Dam Proposed Purposes Over Time

YEAR	PURPOSE
1950	Tobacco production in the Mareeba-Dimbulah Irrigation Area (no specified volume)
2008	30,000 ML HP for urban water supply to Cairns
2010	Cairns urban water supply and agricultural water supply (no specified volume)
2015	Urban and agricultural expansion in the Tropical North (no specified volume)
2015	Long term option for Cairns urban water supply (no specified volume)
2015	12,500 ML for Cairns urban water supply via substitution of Barron sub-catchment E water entitlements back into the Barron River from Tinaroo Falls Dam Remaining yield of Medium Priority water to the Walsh River part of the MDWSS (estimated between 36,000 to 69,500 depending on the size of the dam)

Given the history of previous assessments, Building Queensland engaged MJA to conduct a demand assessment for the proposed Nullinga Dam for both the Cairns urban and agricultural sectors.

[2] For example, Far North Queensland Regional Water Supply Strategy, DEWS Cairns Regional Water Supply Security Assessment, CRC Water Security Strategy, SunWater reports and other data.

Building Queensland also wrote to key stakeholders to confirm the outputs of the MJA demand assessment, and engaged Jacobs and Synergies Economic Consulting to peer review the MJA demand assessment, to ensure its robustness.

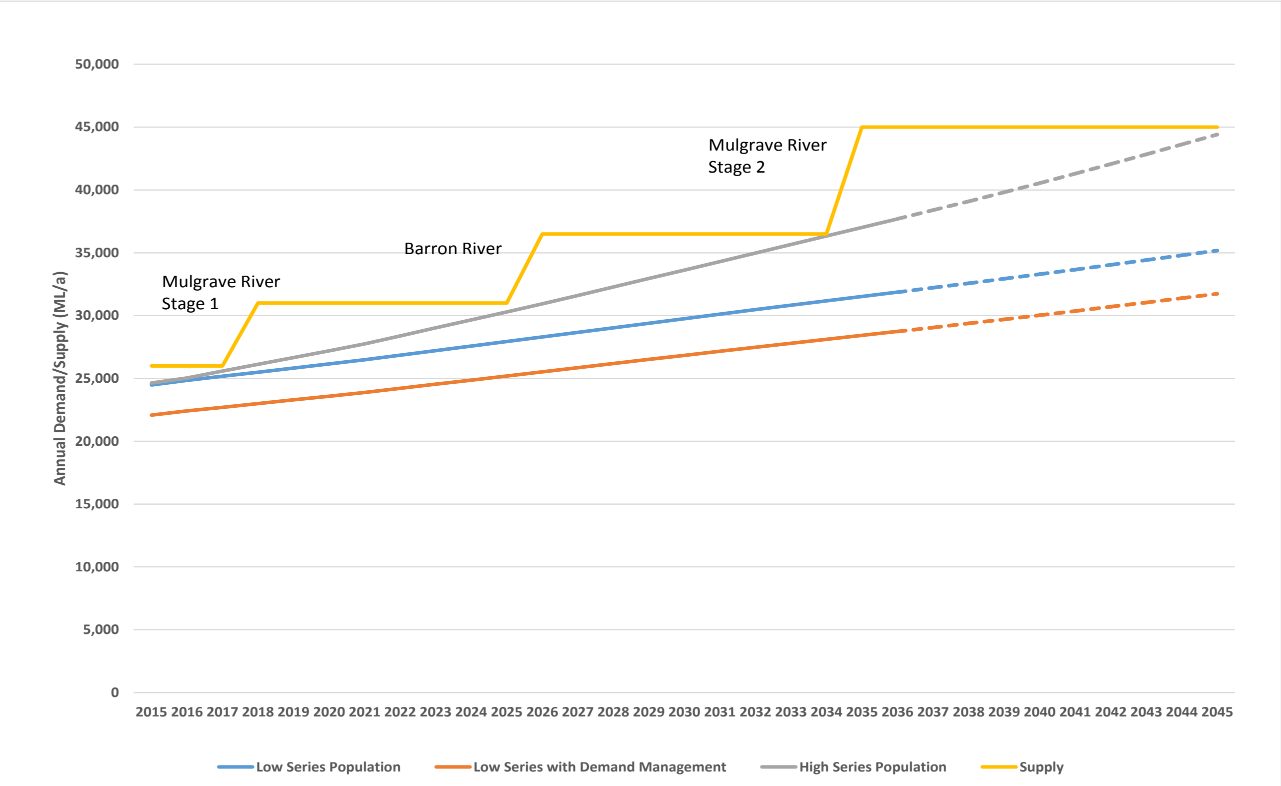
3.5 Cairns Urban Demand

3.5.1 MJA Assessment – Cairns Urban Demand

Key findings from the MJA demand assessment for Cairns urban supply are outlined below.

- In 2016, CRC revisited its water demand forecast in the Cairns Water Security Strategy based on updated population growth projections and revised assumptions regarding the proposed Aquis Resort.
- The revised water demand forecast is shown in the figure below and is based on the low series of the 2015 edition population projection by the Queensland Government Statistician's Office (QGSO) and a baseline per capita demand of 418 litres per capita per day (L/c/d).[3]

Figure 6 MJA Revised Demand Forecast for Cairns Regional Council



Source: CRC and MJA analysis.

Notes: (1) Dotted lines are extrapolations of the data sourced from the Queensland Government Statistician's Office. (2) The augmentation sequence beyond Mulgrave River Stage 1 is for illustrative purposes only. This sequencing will be subject to a further specific comparative assessment.

- The revised water demand forecast by the CRC shows a lower demand profile than the 'Without Aquis' scenario presented in Cairns Water Security Strategy, and well below the 'With Aquis' scenario.

[3] The per capita demand is a composite demand across all sectors including residential, tourism, and other non-residential customers. Further, it is assumed that the proportional demands remain constant over time i.e. demand for one sector does not grow at a higher rate than other sectors.

- CRC's updated water demand forecast means water supply augmentations are now not required until 2019 (comprising Mulgrave Stage 1). This delays the need for augmentations compared with the Cairns Water Security Strategy water demand forecast where water supply augmentations were required by 2017.
- CRC's baseline per capita demand does not take into account demand management initiatives which are predicted to reduce per capita demand from 418 L/c/d to 377 L/c/d over the next 10 years (demand management is a short-term option under the 2015 Strategy as outlined in Table 1 and CRC have subsequently published a water demand management strategy for 2016-2025 with this goal specifically stated and specified measures for implementation). A reduction in per capita demand would consequently enable a deferral of the next supply augmentation (Mulgrave River Stage 1) to potentially beyond 2026, and subsequent augmentations to beyond 2036.
- The revised water demand forecast and predicted timings of future augmentations will be confirmed as part of CRC's development of its Emergency Water Supply Plan, which is scheduled for completion in the second half of 2017.
- CRC is undertaking a review of the Level of Service performance criteria and targets of its water supply system. This could lead to timing of planned augmentations being pushed out should CRC elect to change its Level of Service (e.g. changing system performance triggers or increasing frequency of restrictions).
- Under current population/demand forecasts, CRC has an implementation plan of CRC owned and operated supply measures in place to meet its future demand for at least the next 30 years and does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long term. CRC's supply measures include implementation of a demand management strategy and utilising currently held reserves in the Mulgrave and Barron Rivers through development of water supply and treatment infrastructure. Beneficial water trading opportunities are also identified in the Mulgrave catchment.

3.5.2 Building Queensland Correspondence—Cairns Regional Council

Building Queensland wrote to CRC outlining key findings of the MJA demand assessment and requesting confirmation. CRC responded to Building Queensland confirming the MJA findings subject to a number of provisos which were addressed in the PBC.

3.5.3 Jacobs Peer Review—Cairns Urban Demand

Building Queensland engaged Jacobs to peer review MJA's demand assessment for Cairns urban demand. Jacobs concluded that CRC's process was robust and the Cairns Water Supply Strategy was sound, and there was no Cairns urban water supply problem to solve using Nullinga Dam in the timeframes considered in the PBC.

3.5.4 Synergies Economic Consulting Peer Review—Cairns Urban Demand

Building Queensland also engaged Synergies Economic Consulting to peer review the demand assessments. Based on the evidence presented, Synergies Economic Consulting agreed with the conclusion that the construction of Nullinga Dam is not necessary to meet Cairns urban water supply needs over the next 30 years.

3.6 MJA Demand Assessment—Agricultural Demand

Key findings from the MJA demand assessment for agricultural demand are outlined below.

- There are three key agricultural demand drivers in the region:

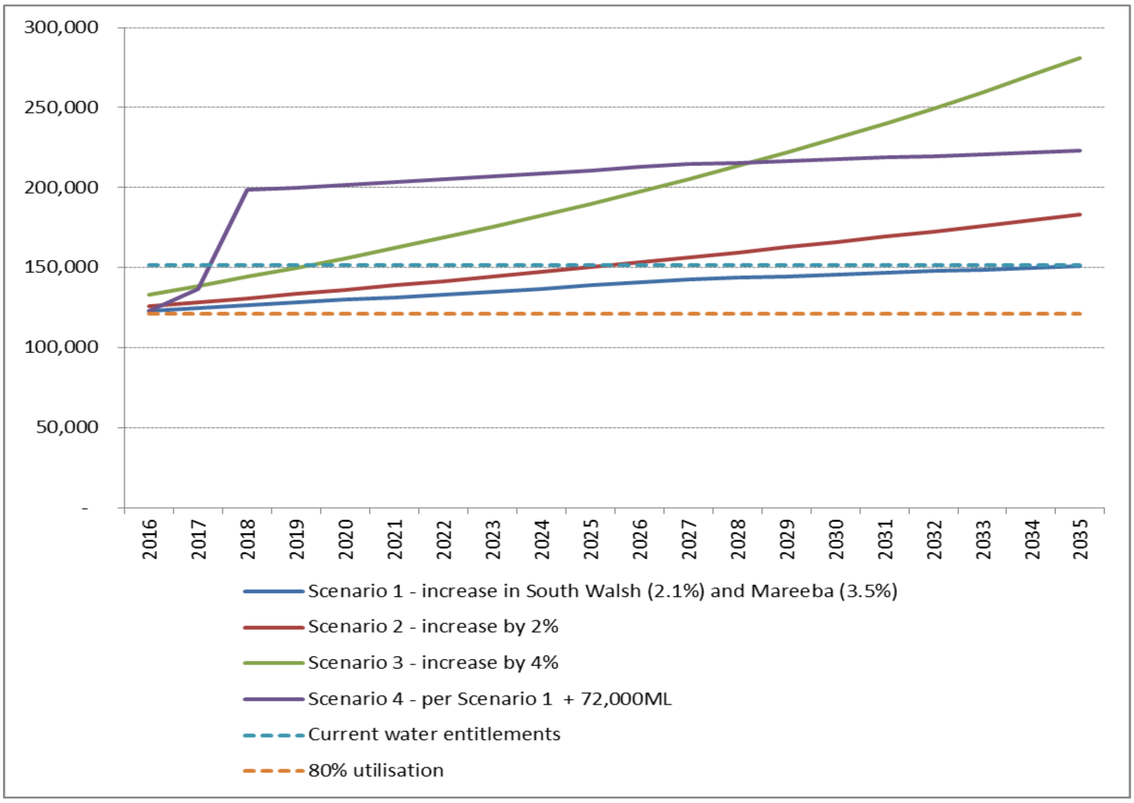
  - Dry conditions and water security – persistent low rainfall since 2012-13 has resulted in higher than average level of water utilisation and emerging water security concerns by irrigators
  - Crop profile – change in crop profile to higher value permanent plantings, e.g. avocados and bananas, which require high water security and increasing amounts of water, especially as plantings mature
  - Industry growth – consultation with industry in the region indicated potential for up to 72,000 ML of additional water demand within the next 30 years, subject to a number of factors including access to additional land, supply chain constraints, investment in 'value-add' facilities and broader market factors.
- Recent dry conditions mean that current system utilisation exceeds 80 per cent, which is above the water security buffer generally desired by irrigators. Maintaining a percentage of entitlement holdings as a buffer against dry conditions is desirable for crop longevity.
- Strong growth in permanent plantings of high value crops such as avocados and bananas requires more water so demand will continue to grow, albeit off a relatively small base when compared to sugarcane.
- Growth in water use in the region since 2002-03 has averaged less than 1.0 per cent per annum. Two sub-systems have experienced higher growth: Mareeba (3.5 per cent) and South Walsh (2.1 per cent). Recent years have also seen the limits of specific elements of the delivery system being reached, most notably in the East Barron system, for which peak demands now exceed the capacity of the system.
- Future industry growth in the region may be largely driven by MSF Sugar. MSF Sugar, an integrated grower, processor, marketer and exporter of raw sugar, owns and operates the Tableland Mill within the MDWSS area. The Tableland Mill commenced operations in June 1998. It is the newest and most technologically advanced sugar mill in Australia. Since 2012, the Mill has been owned by Thai based Mitr Phol Group, a large global sugar milling company. MSF Sugar is currently milling about 800,000 tonnes of sugar per year at the Tableland Mill (the mill currently has capacity to mill 930,000 tonnes), of which 400,000 tonnes are under a tolling arrangement from Mossman Mill, owned by Mackay Sugar. In addition, MSF Sugar is the largest water holder in the MDWSS with around 16,350ML of water entitlements.
- Based on analysis of historical water demand and feedback from stakeholder consultation four future agricultural water demand scenarios were developed and assessed:
  - Scenario 1 based on historical growth rates at an operational system level: annual growth rates of 3.5 per cent for Mareeba sub-system and 2.1 per cent for South Walsh sub-system for 10 years and then 0.7 per cent annual growth rate thereafter. For the rest of the operational systems, 0.7 per cent annual growth rate
  - Scenario 2: 2.0 per cent annual growth rate for the whole system, equivalent to QTC's estimate in the QTC Nullinga Dam Report.
  - Scenario 3: 4.0 per cent annual growth rate for the whole system, as expressed by some stakeholders.
  - Scenario 4: growth rates as per Scenario 1 plus an estimate for industry expansion of 72,000 ML by 2018, for illustrative purposes.
- These scenarios should be compared with the annual average growth rate of water deliveries to the MDWSS (including losses) between 1981 and 2016 of 3.6 per cent per annum,[4] and the Far North

[4] SunWater annual reports.

Queensland Regional Water Supply Strategy (2010) indication of an average annual growth rate of 1.0 per cent to 2.0 per cent in the MDWSS, up to the limit of existing supplies.

- These scenarios were modelled against the 2012-13 year, just prior to the recent low years of rainfall, to remove the impact of recent dry conditions. Scenario 1 represents the most conservative forecast, scenario 2 a medium forecast, and scenarios 3 and 4 high growth scenarios.

Figure 7 MJA Agricultural Demand Forecast Scenarios



Source: MJA

- Scenario 1 was considered the most likely scenario, in the absence of significant expansion from established industry. Scenario 1 is based on past irrigation demand.
- Based on Scenario 1, there would not be an immediate need for large scale water supply augmentation. However, it would be prudent to undertake small scale water supply augmentation to address irrigators' water security concerns. Where the system is supply constrained it would necessarily constrain future expansion.
- Scenarios 2 and 3 should be interpreted with caution. These scenarios may be driven by the significant uptake in water use in 2015-16 due to prolonged dry conditions. They may also overstate the demand for water longer term.

3.6.1 Building Queensland – Confirmed Demand Assessment

Building Queensland engaged with local government, industry and economic development groups, and large scale commercial irrigators to confirm the demand assessment.

3.6.2 Jacobs Peer Review – Agricultural Demand

Building Queensland engaged Jacobs to peer review MJA's demand assessment for agricultural demand. Key findings from the Jacob's peer review are as follows.

- Agricultural demand for new water supplies and willingness to pay has historically been extremely difficult to predict, but while urban supply generally responds to predictable demand based on population growth, the inverse can be true for agricultural water supply where water and land availability drive demand: irrigators cannot expand in schemes that are fully allocated unless a 'step change' in supply occurs.
- Generally, irrigators will not allow demand to exceed available supply (due to the risk of losing high-value long life tree crops). Rather, faced with water scarcity (and supply constraints) irrigators will reduce rates of application resulting in constrained agricultural production. Moreover, in dry times and when a scheme reaches capacity, irrigators will forgo future growth via new plantings, rather than risk losing the capital expenditure required to establish new irrigation areas and crops.
- MJA used an incremental approach to assessing agricultural demand, that is, 0.7 to 4 per cent per annum growth. This approach has some limitations and is not considered the most appropriate measure of agricultural demand growth once a system is constrained by supply, which has been the case in MDWSS for the past 2 to 3 years. Agricultural demand is not considered likely to reflect forecast linear growth, particularly when scarcity is experienced. Rather, it will only grow materially if a new supply is developed. The methodology adopted by MJA may therefore understate demand.
- MJA recognised 'step change' to an extent in its documentation of potential industrial demand for water allocations, which in the MJA model assumes the following.

Table 6 Marden Jacob Associates Assumptions

SCENARIOS	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1	123,148	124,757	126,397	128,068	129,771	131,508	133,278	135,083	136,923	138,800
4 = 1 + Industry growth		12,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Scenario 4	123,148	136,757	198,397	200,068	201,771	203,508	205,278	207,083	208,923	210,800

Source: Marsden Jacobs Associates

- Jacobs cautions against over-reliance on demand Scenarios 1 to 3 (reflecting 0.7 to 4 per cent ongoing annual growth) as they are based on historical incremental growth and may not fully account for recent water scarcity in MDWSS and the way in which irrigators are responding to these supply constraints.
- Jacobs tested the existence of step-change demand with key industry stakeholders in the region at a high-level. Jacobs considers MJA's Scenario 4 may occur if established industry's expansion plans do come to fruition, for example, crystallised by a new source of water allocations.

3.6.3 Synergies Economic Consulting Peer Review—Agricultural Demand

Building Queensland engaged Synergies Economic Consulting to peer review the MJA and Jacobs demand assessments. Key findings from the Synergies Economic Consulting peer review are as follows.

- MJA has assembled a reasonable body of evidence to indicate there is no immediate water scarcity in the MDWSS and there is enough supply in the current system to support incremental growth in demand.
- Synergies Economic Consulting agrees with MJA's conclusion that Scenario 1 represents the most likely scenario for future agricultural demand for water in the region.

- While there is scope for the robustness of the conclusions drawn by MJA to be strengthened by a farm-level financial assessment, the analysis conducted and conclusions drawn by MJA with respect to future demand for irrigation water in the region are considered appropriate for a PBC.
- Based on the available evidence, there is not persuasive evidence of latent demand that supports a step-change in agricultural demand for water on a user pays basis, as proposed by Jacobs. Established industry's expansion plans would represent a quantum change in demand, but the land required for expansion appears to exceed the available limit of suitable land remaining for irrigation in the MDWSS.
- It is not considered appropriate to include established industry expansion in the base case demand forecast, as it remains untested in terms of the strength of the economic case. There has not been sufficient analysis of the viability of expansion of sugar cane production and the economic value of the use of additional volumes of irrigation water for this purpose without more robust evidence.
- Synergies Economic Consulting noted that in the absence of new, major bulk water customers, incremental additions to supply are generally preferable as they are less expensive and have greater scalability, and should be pursued prior to major irreversible supply augmentations being pursued.

3.7 Stakeholder Views

Key stakeholders with expertise and interest in the potential service need include government agencies, local government, industry and regional organisations. This section outlines key observations in relation to stakeholder engagement on the service need.

3.7.1 Cairns Urban Demand

- CRC has developed a Water Security Strategy with both community and technical input which sets out its plan to meet its water security needs for the next 30 years, including consideration of the potential for the proposed Aquis Resort to be developed to its full capacity.
- In the Water Security Strategy, CRC has not prioritised Nullinga Dam or other external water sources, even in their long-term options. Rather, the short and medium term initiatives are focused on CRC owned and operated options.
- CRC's 2016 revised demand forecast indicates that external sources such as Nullinga Dam are not needed by Cairns until the very long term. The revised demand profile for Cairns urban demand (as set out in this Chapter of the PBC) is considered correct.
- If converting MDWSS losses is pursued for agriculture it may remove an option CRC has identified as a possible long-term water supply option. However, this option is strategic planning and not 'as of right' for CRC (in comparison to CRC's current strategic reserve of 4,000 ML in the Barron River).
- In any event, if losses in the MDWSS were converted to allocations, CRC would be in the position of any other buyer in the water market and may seek to purchase converted allocations for urban use.

3.7.2 Agricultural Demand

- There is a regional opportunity for growth in agriculture. There is a perception the existing distribution system is at capacity, or will reach capacity in the near future.
- Water security brings with it certainty for future investment. Increased water supply is directly correlated to confidence to invest (crop expansion and diversification, recreation, tourism, etc.).

- There is a need to provide rigour around the demand projections that will inform sequencing and priorities.
- Water efficiency improvements and water trading are already happening.
- There is a clear stakeholder expectation that options for future water supply should be considered together, as a system.
- There is an acknowledged difference between the east and west areas of the MDWSS, with the east having a larger proportion of higher value crops and sugarcane. This difference also relates to potential price of water, and the equitable management of customers moving to any new scheme.
- Equitable outcomes depend on the cost of water. If the cost of water is too high, additional water supply will not benefit anyone.

3.8 Service Need for the PBC

In consideration of the above analysis, the following service need for the PBC was presented to the Project Steering Committee in February 2017 and endorsed.

There is no Cairns urban water supply service need to be addressed.

CRC has a portfolio of identified water supply measures recognised within existing water resource planning frameworks that could be implemented to meet future demand for at least the next 30 years. It does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long term.

There is an opportunity to expand agricultural production on the Atherton Tableland by increasing the availability of supplemented MP allocations.

In addressing this opportunity, two existing issues should be to be considered:

- Agricultural production and growth is constrained when irrigators exceed their stated scarcity buffer (e.g. 70 to 80 per cent water use as a portion of available allocations) and conserve water to protect longevity of crops at dry times.
- Water cannot be moved to certain areas because of capacity constraints in the MDWSS water distribution system (e.g. East Barron and Arriga areas) and a lack of infrastructure in greenfield areas.

3.9 Benefits Sought

3.9.1 Anticipated Benefits

It is anticipated that addressing the service need may provide the following benefits:

Table 7 Anticipated Benefits from Addressing the Service Need

BENEFIT-RELATED PROJECT OUTCOME	BENEFIT DESCRIPTION	BENEFIT TYPE	BENEFIT UNIT OF MEASURE
Enhanced usage of water delivery infrastructure for agricultural production	Extent to which producers use more of their annual allocation and maximise the utilisation of existing infrastructure	Quantitative Non-Financial	ML of increased use as a portion of nominal entitlements
	Additional Gross Value Product (GVP) of regional agricultural activities (2015 baseline) related to intervention	Quantitative Financial	Dollars ($)

BENEFIT-RELATED PROJECT OUTCOME	BENEFIT DESCRIPTION	BENEFIT TYPE	BENEFIT UNIT OF MEASURE
Increase in regional employment from enhanced agricultural productivity	Number of direct additional agricultural jobs created	Quantitative Non-Financial	FTEs
Improved use of existing resources through changing water business practices	Extent to which producers use more of their annual allocation and maximise the utilisation of existing water resources	Quantitative Non-Financial	ML of increased use as a portion of nominal entitlements
Change in land use to higher value per hectare crops in suitable areas. Monetised in the CBA	Additional GVP of regional agricultural activities (2015 baseline) related to the intervention	Quantitative Financial	Dollars ($)
Enhanced confidence to invest in long term business operations and succession opportunities	Level of business confidence within the agricultural sector to make long term investment	Quantitative Financial	Dollars ($)
Increase in value and flexibility of existing water allocations	Extent to which additional water trading will be undertaken and increase the value of water traded	Quantitative Non-Financial	Volume and dollar value of water traded
Equitable allocation of additional water may add to sense of social cohesion	Extent to which additional water supply adds to the sense of social cohesion	Qualitative	
Reinforce importance of agriculture to the study area (character and identity)	Extent to which additional agricultural production adds to the sense of place and identity	Qualitative	
Positive impacts in relation to community vitality—increase in employment opportunities help to retain/attract people to the area	Amount that implementation adds to the employment and population of the region	Quantitative Non-Financial	Hours
Development of additional community support services and improved community facilities and health	Number of additional community support services developed due to additional short and long term investment	Quantitative Non-Financial	Other Benefit Measure 1
Opportunities for indigenous business development and employment	Number of additional indigenous businesses developed due to additional short and long term investment	Quantitative Non-Financial	Other Benefit Measure 1
Development of new governance and planning support arrangements	Success of implementation of new governance and planning activities	Qualitative	
Opportunities for additional recreation areas	Number of additional recreational activities delivered through new bulk water supply	Quantitative Non-Financial	Hours

3.9.2 Dependencies

There are a number of dependencies in relation to the achievement of these anticipated benefits.

The first key dependency is irrigators responding to any intervention to address the service need, by either:

- changing water use practices
- taking up new water allocations to increase agricultural production (which includes consideration of volume, location, willingness to pay and capacity to pay)
- investing in on-farm infrastructure to service new agricultural production

- changing land use to higher value agriculture.

The second key dependency is the proposed transition of the distribution system of the MDWSS to LMA. If this proceeds, intervention to address the service need will depend upon the proposed approach taken by the MDWSS distribution infrastructure future owners and local irrigators. This response will be essential to produce any of the wider benefits indicated above.

3.9.3 Criticality of Intended Outcomes and Benefits

The anticipated outcomes and benefits are not considered critical to the ongoing functioning of the regional economy or to underpin the future wellbeing of the community in the Atherton Tablelands.

However, community issues including unemployment and an aging population (health and services) may be considered important to address by local governments, Queensland Government and the Australian Government. The Australian Government's NWIDF has stated that regional development is an important objective of the NWIDF.

3.9.4 Conflicts or Opportunities for Collaboration Between Stakeholders

Nullinga Dam has traditionally been proposed as an urban water supply for Cairns and an irrigation water supply for agricultural production on the Atherton Tablelands. Achieving these two water supply needs from one water supply source is complex as it would involve the 'swap' or 'situation' of existing water allocations for new water allocations. The removal from the service need of the provision of water supply to Cairns removes a critical point of potential conflict between CRC and the Tablelands community.

3.9.5 Potential Dis-benefits and Risks to Achieving the Benefits

The Social Impact Evaluation and Environmental Assessment chapters outline the potential low to high areas of dis-benefit for addressing the service need, including impacts on the environment from increased irrigation activity and potential adverse cultural and social impacts.

3.9.6 Potential Initiatives

The potential initiatives that could address the service need are outlined in Chapters 4-6.[5]

3.10 Base Case

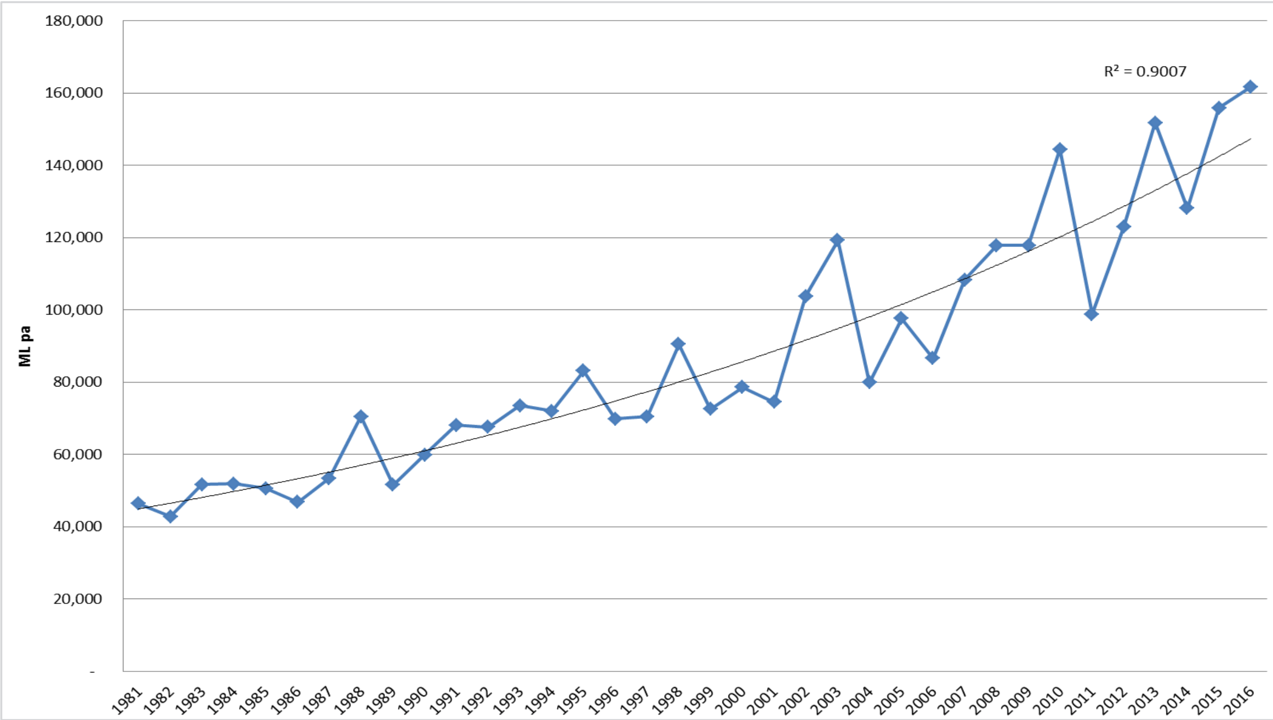
The base case is the status quo or business as usual.

As the service need is an opportunity (rather than a problem), it is considered there is no base case in which any sector will run out of water supply catastrophically. However, when faced with scarcity at dry times, irrigators will reduce application of water on the lowest value crops. Irrigators will also not expand (plant new crops) if the current supply situation indicates there is a reasonable prospect of losing those crops and the associated capital investment.

There has been an upward trend in water deliveries in the MDWSS over time. The water deliveries in the MDWSS between 1981 and 2016 are shown in the figure below and the rate of change since 1990 is shown in the table below. This data shows that for the last 35 years MDWSS deliveries have grown on a geometric average of 3.6 per cent per annum and simple average growth has been 5.1 per cent per annum.

[5] No Strategic Business Case was prepared prior to the PBC.

Figure 8 Water Deliveries in the MDWSS 1981–2016



Source: SunWater Annual reports; DNRM

Table 8 Rate of Change in MDWSS in Water Deliveries Over Time

WATER YEAR	ACTUAL TINAROO FALLS DAM IRRIGATION DELIVERIES (ML/A)	ACTUAL ANNUAL CHANGE AND SIMPLE AVERAGE (%)	ANNUAL GEOMETRIC AVERAGE (%)
1990	59,851	16.0%	
2000	78,568	8.3%	
2010	144,395	22.5%	
2015	155,887	21.7%	
2016	161,667	3.7%	
Average 1981 to 2016	87,238	5.1%	3.6%
Average of last 14 years	119,649	7.7%	5.3%
Average of last 10 years	130,760	8.3%	6.4%
Average of last 5 years	144,084	11.6%	10.4%
Average of last 2 years	158,777	12.7%	12.3%

Source: SunWater Annual Reports; DNRM

On the basis that water is now fully allocated and demand and water deliveries have levelled out, the economic base case is likely to closely reflect the value of production and employment in 2015-16 going forward. Changes will relate to changes in technology, which may overtime increase labour productivity, marginally reducing jobs in the agricultural sector. This impact on labour may however be countered by increased labour-intensive harvesting, processing and/or packaging, as higher value crops increase on the Tablelands.

Similarly, the base case value of agricultural production from the region may exhibit (modest) increases as higher value crops increasingly replace sugar cane on the most valuable land, subject to water availability. For high value crops, water availability will in part reflect the existing capacity to pay of high-value irrigators, who may be able to identify willing sellers of existing MDWSS allocations if the price is sufficient to entice a sale.

The base case is therefore likely to feature:

- Little or no increase in water deliveries to the extent that capacity has, or is close to being, reached (when available, 2016-17 will assist to establish if this is the case)
- Increased moves by the irrigation sector towards on-farm water efficiency and higher value production (to the extent that high-value producers have not already reached optimal water use - trickle irrigation is widely used on tree crops)
- Water trading at high values towards high value crops on the most fertile soils within the scheme – leading to an expansion of high value horticulture within the region
- Static or potentially modest expansion of sugarcane production by MSF Sugar and other producers resulting from increased yields due to improvements in on-farm water use efficiency. Given the current water constraints, the base case is unlikely to see expansion of sugar cane without a new source/supply of water allocations.

Employment impacts under the base case are somewhat uncertain, depending on crop type and technology in the long term. However, to the extent that gross production values increase, direct and indirect employment may grow at a similar rate.

The base case for environment and social indicators is expected to follow the patterns described in the relevant chapters of the PBC.